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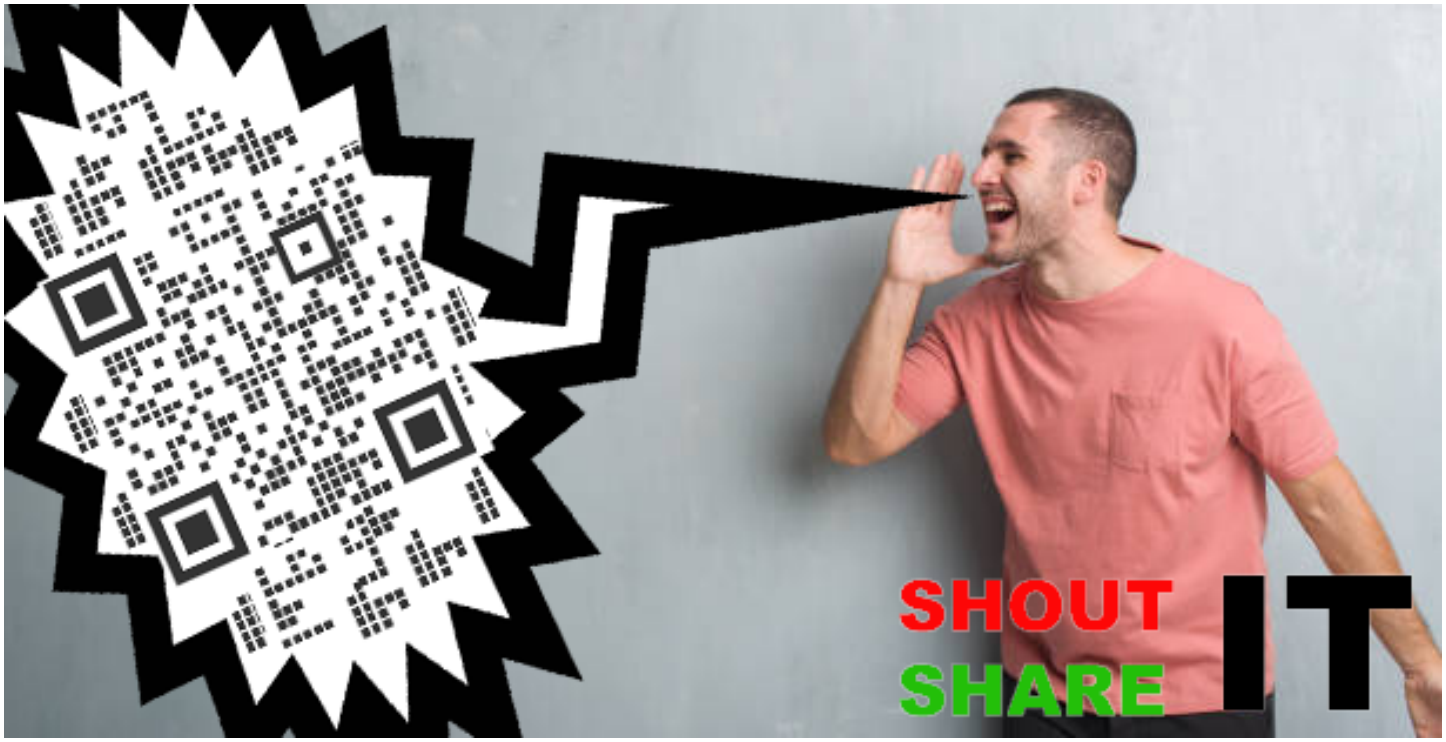
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Underwood and Underwood.

The Origin of Man from the Anthropoid Stem
When and Where?

(*From Bicentenary Number of American Philosophical Society's Proceedings, Vol. LXVI*, 1927)

By WILLIAM K. GREGORY

PROFESSOR OSBORN has recently argued that for more than one million years past our ancestors have been erect-walking, large-brained, speaking men, not differing in essentials from the human genus of to-day and contrasting profoundly with the arboreal or semi-arboreal great apes.

This immense vista of man's antiquity and of his aloofness from other mammals has called forth more than one expression of thankfulness that the much maligned human race has at last been freed by anthropological science from a degrading sense of kinship with apes and monkeys —repulsive creatures whose very names in ancient and modern times have been used in contempt and derision. This bar sinister in man's reputed pedigree has been viewed with horror by many anti-evolutionists, who have sought by every artifice of rhetoric to discredit the idea; but scientists of world-wide reputation have also striven either to secure a verdict of "not proven" or to establish a complete alibi for mankind.

And now Professor Osborn hands down a decision at first sight quite adverse to the claims of the anthropoid tribe to the place of honor as man's next of kin. Specifically, he holds that these animals "constitute a separate branch of the great division of primates, not only inferior to the Hominidæ but totally disconnected from the human family from its earliest infancy."

But, like the slave in the classical story whose unpleasant and doubtless risky duty it was to remind royalty *"Memento te hominem esse."* I conceive it as my hard duty to remind mankind that these poor relations of ours, mute witnesses of the past, are still with us and that the evidence of our lowly origin can hardly be waved aside on the ground of the length and aloofness of our own lineage.

If we concentrate our attention on the evidence for the, at first, almost inconceivable antiquity of man as an independent family, we may easily forget that the Pliocene epoch is next to the nearest to us of a long line of known geologic epochs, most of which are many times longer than the Pliocene itself. If we accept Barrell's estimates based on the rate of disintegration of uranium into lead and helium, we find that even the Lower Pliocene is only some six million years distant from us, while the beginning of the Eocene is set down as some sixty million years ago. And what is this in turn, compared with the 700 millions of years since the beginning of the Palæozoic? At most, the human race has then been proved to be a superior line of its own for less than one hundredth part of the time that bivalve molluscs have been separate from univalves or sponges from corals.

Man is not the only mammal of the Pliocene epoch that was already substantially like his modern representatives. Palæontologists have shown that the same is true of the horses, tapirs, rhinoceroses, elephants, bears, pigs, monkeys, apes and many other mammals. In other words, the amount of evolution that has apparently taken place since Pliocene times in all these groups appears at first sight to be surprisingly slight.

However, if the geologic epochs themselves extend as many millions of years as they are supposed to do, is it any wonder that the old "phylogenetic trees" have been lengthened into clusters of nearly parallel lines, converging only at extremely distant points? But because horses and asses may have been on separate lines far longer than was formerly thought are they in reality any less nearly related to each other than they were before? And in general are zoological relationships, *e.g.* of the horse to the rhinoceros and the tapir, really altered because our ideas of the antiquity in years of all creatures has been greatly expanded?

Partly because the amount of evolution since Pliocene times appears at first sight to have been very slight and because evolution in the horses, proboscideans, and many other families has usually been extremely slow throughout the Tertiary period, it might be suspected that evolution in man has been equally slow and that man will be proved to be distinct from other families as far back as the families of horses, rhinoceroses, proboscideans, etc., were separate from each other; that is, as far back as at least the Eocene epoch.

However, primitive horses, with undiminished side toes and short-crowned teeth, in general characteristic of the Oligocene epoch, persist in the Miocene, side by side with more progressive families with reduced side toes and long-crowned teeth, leading to modern horses. So, too, it is generally recognized that certain groups have changed but little during enormous reaches of geologic time, while others have become profoundly specialized during the same period. Among the mammals, the opossum has come down to us with only slight modifications in the dentition from the primitive marsupials of the Upper Cretaceous. The family of horses, on the other hand, during the same period underwent intensive modifications. In view of all this, where is the direct evidence that the evolution of man has proceeded at approximately the same average rate as that of the horse and his congeners, and that the two families date back equally far in geologic time?

Before taking up the direct palæontological evidence on this matter, let us consider several lines of indirect evidence.

If man and ape had parted company as long ago as did tapir and horse, their relatively higher instability should have made their molar patterns far more different from each other than those of tapir and horse, whereas the contrary is the fact. This assuredly adds weight to the argument that the kinship of man to the chimpanzee is

far closer than that of the tapir to the horse, and that the separation of the first pair was a much later event than the separation of the second pair.

Those who oppose Darwin's conclusion that man is an offshoot from the anthropoid stem must attribute to "parallelism" the numerous resemblances between the anthropoid dentition and that of man, notwithstanding the fact that these resemblances persist in spite of the profound differences in diet between the prevailingly frugivorous apes and the prevailingly carnivorous-herbivorous man. But if the very numerous detailed and fundamental resemblances between anthropoid dentition and that of man are due to parallelism, what warrant is there for using quite similar dental resemblances and differences for uniting and distinguishing the members of the families of elephants and odd-toed hoofed animals?

In judging the interrelationships of the members of any large group the evidence derived from the dentition should of course be supplemented and checked wherever possible

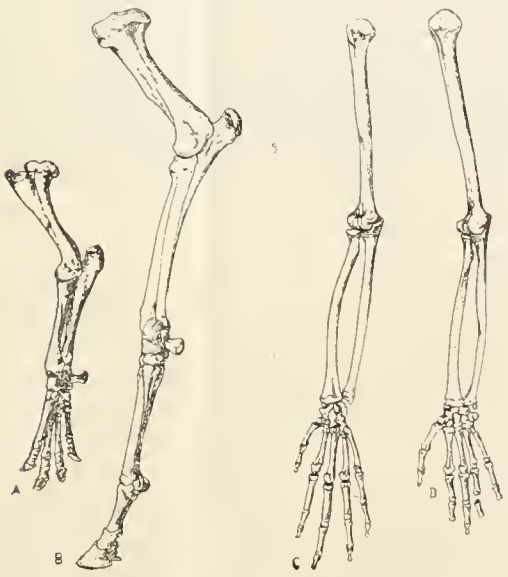

Fig. 1.—*Skeleton of right fore limb of A, Tapir; B, Horse; C, Chimpanzee; D, Man (Feddah). C and D after Sarasin.*

by the characters observed in other parts of the body, especially the skeleton of the limbs and feet. Let us apply this test to our inquiry as to whether chimpanzee and man are more nearly allied in structure than tapir and horse. Fig. 1 will enable the reader to compare the forearm and hand of chimpanzee and man on the one hand and of tapir and horse on the other.

Is the difference in the forearm and hand of chimpanzee and man anywhere nearly so profound as that between tapir and horse? Here the evidence suggests that even on the assumption of equal changes in equal times, chimpanzee and man have not been separated nearly so long as have tapir and horse, and again it will be noted that this greater resemblance between chimpanzee and man persists in spite of the marked difference in their habits.

The differences between the hind limbs and feet of chimpanzee and man, while very conspicuous, are on the whole not nearly so great as the differences between the hind limbs and feet of tapir and horse (Fig. 2). According to the well established principle of adaptive radiation, after the descendants of an ancient common stock pass from the ancestral life-zone to a new one, their whole locomotor skeleton becomes adapted to the new mode of life. It is well known that these new adaptations tend to cover-up and obscure the characters inherited from the older environment and contrasting widely with each other in their modes of locomotion, show the maximum contrast in their mind limbs, whereas the horse and the tapir, continuing to use their limbs in much the same way as did their remote common ancestors, differ from each other chiefly in the fact that in the horse tendencies toward centralizing the axis of the foot, which are already clearly visible in the tapir, have been carried to the extreme. And it will be shown presently that in spite of the striking difference of the human foot from that of the chimpanzee, its origin is perfectly explicable on the hypothesis that it has been derived from the foot of a primitive anthropoid type by a definite change of function involved in the abandonment of arboreal life and the assumption of bipedal running habits.

The striking difference between the foot of the anthropoids and that of man has led Sir Ray Lankester and others to regard the evolutionary gap between anthropoids and man as equally profound and has been the principal objection to Darwin's theory of the origin of man. This brings us to the very kernel of the whole question, namely, was man's place in nature correctly determined by Darwin, Huxley and Haeckel; is he still definitely the next of kin to the anthropoid stock, or does he represent an entirely independent group of unknown origin and relationships?

(Prof. Gregory's answer to this question will appear in our next number).

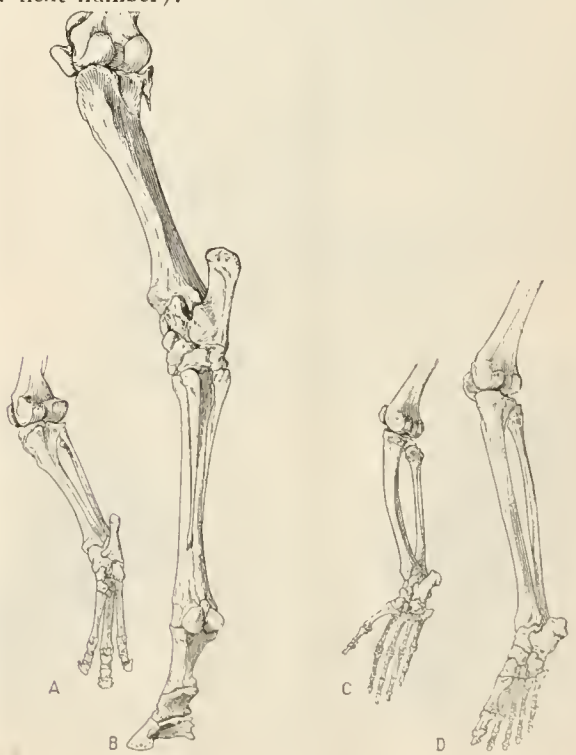

Fig. 2.—*Skeleton of right hind limb of A, Tapir; B, Horse; C, Chimpanzee; D. Man.*

Brains—How Come?

By ALLAN STRONG BROMS

V.

MAN'S big advantage over his fellow animals is his adaptability. He got that from the babies. Paradoxically, they helped him by being helpless. They did the finest job of brain building ever—for man's is not only bigger, but really different. Yet it grew out of the animal brain and certainly was not a special creation.

The animals—meaning the other animals—act by instinct. They are born that way. For instincts are just race habits, inherited and all set to go. Being on hand at birth, they need not be learned and they fit the animal young to start off living full-fledged. Our babies can't do that; *but they can learn.* Grown up, they beat the world.

Our babies are helpless for lack of the self-preservative instincts. That sounds like a handicap, but it's an asset,—if there are parents around to substitute at preserving from hunger, cold and danger. With parents on the job, instincts are superfluous and only tie us to ways of our ancestors, ways once good in their time and place, since natural selection picked them for race habits, but now out-of-date. For the world has moved and new problems face us. Our ancestral ways have turned to handicaps and must be done over for present fitness.

But how change? One of two ways. By natural selection through the survival of such children, grand-children, great-grand-children, great-great-grand-children, and so on, that happer —just happen—to vary towards fitness to the new times and places. Either that way, or through the adaptable mind, that can learn how *now*, that can train to do in new ways and think out solutions for new problems. The animals, instinct guided, win in the gamble for survival if their evolution beats the environmental changes. Man beats them all through quick changes, by training and invention. For that he must thank the babies.

For the baby (protected by parents), can start off with a clean mental slate. He is not cluttered up with wrong answers, with out-of-date instincts that served the simple jungle needs of his ancestors, but can never meet the complex needs of our human lives. The clumsy and inarticulate baby can do almost nothing to start with, but potentially he is a Jack-of-all-trades. He starts as a squirming bundle of waste motions,—kicks, gurgles, wails, and waving arms. There are lots of motions to pick from and some prove useful (pleasurable) and survive through repetition. The others lapse through disuse or are suppressed as in the way. Repetition gives skill to the survivors, for practice makes perfect. These acquired habits are ruts like instincts, but we make them ourselves to fit present needs and we can change them if need be, for they are less deeply rooted. Once acquired, they serve as the mind's private secretary, attending to routine details and leaving the big boss mind to tackle new problems.

For also, the human mind invents solutions for problems. Not so the beast's. He is all primed to act, not to think. Something in his world touches him—through ears, eyes, nose, touch—a stimulus. He responds with automatic action—trigger-quick—instinctively. In his jungle world, he who hesitates is lost. Man's world is fairly free from such dangers, but full of complex problems, and many apparent solutions, some right, some wrong. So he must choose and combine acts and means in new ways to get new results. In his world, he who does not hesitate—and think inventively—is lost.

For such thinking and doing, man needs a lot of facts and training, true facts about his world, what he may expect of it and what he can do with it, and trained skill in his many, diverse doings. So much learning needs a lot of time for education, time free from the cares of serious labor and living. Childhood, under parental care, gives that carefree time. With us it may average sixteen to twenty years when we can play at living—which is good practice—and experiment with this and that — and soak up lots of useful facts, before we settle down to business. Through this period of "schooling" we get human adaptability, our big lead on the other animals. You can almost measure the adaptive intelligence of any animal by the length of its infancy. The mammal mother, nursing her baby, watching over it, playing with it, took a big step forward towards better brains. And because our babies start off with just enough instincts to get by with under parental care and take so long in growing up, we ourselves finish up well informed, skillful and resourceful, able to make so much of the world into which we come. We take more time getting ready, so we do a better job.

The babies really made us, of course with the help of better seeing eyes, handy free hands, and improved brain connections and other good aids to body and brain. Also they made us *over*, gave us parental and family feelings, the real bonds of matrimony being baby ribbons. That made a fine foundation for the other social sentiments which followed and made us all a lot easier to live with. Brain and so-called soul, we owe them largely to the babies.

The next article will be on "The Inside of the Brain Works".

A bundle of waste motions and unbound capacities. —Courtesy Billy Katterfeld

Rulers of the Ancient Seas

By FREDERIC A. LUCAS

Honorary Director, American Museum of Natural History

JUST as Greece, Carthage and Rome in turn ruled the seas in the days we call old, so, long before the advent of man, the seas were ruled by successive races of creatures whose bones now lie scattered over the bed of the Mediterranean. For a time the armor-clad fishes held undisputed sway; then their reign was ended by the coming of the sharks, who in turn gave way to the fish-lizards, the Ichthyosaurs and Plesiosaurs.

Though they were big for reptiles and some were real giants, fifty feet long, they do not merit the adjective "gigantic" so liberally bestowed upon them. They were of many species of assorted sizes. The smaller Ichthyosaurs were, so to speak, reptilian porpoises, but provided with four useful paddles instead of just two, in addition to a powerful tail whose shape and use were long unsolved problems. This long tail was bent at a sharp angle to the backbone and this was taken to mean the

Ichthyosaurus (the fish-lizard) pressed flat on a rock slab. —Courtesy Am. Museum Nat. Hist.

existence of horizontally flattened tail. But when a finely preserved specimen came to light, lying upon one side and having the tail in place, lo it was much like the tail of a shark, only reversed, the lower lobe being longer than the upper. This means that the reptile came to the surface to breathe, while the shark goes down in search of food and to escape danger. The more perfect specimens also showed an unsuspected high back fin precisely like that of a porpoise.

The long-necked Plesiosaur was like "a snake threaded through the body of a turtle", the shell, however, being lacking, as the body was covered by a smooth skin. Despite the snake-like neck, the Plesiosaurs may have been a stiff-necked tribe on account of their biconcave vertebrae.

Having played their roles of rulers of the seas, Ichthyosaurs and Plesiosaurs in due time passed off the stage of life to give place to the great marine reptiles called Mosasaurs, that extended their empire around the world, from New Zealand to North America. Great they were, but there is a universal tendency to magnify the reptile we never saw as well as the fish that "got away," and the greatest of animals will shrink before a two-foot rule. No animals known to have existed were ever larger than our whales and few Mosasaurs exceeded in size a first-class Crocodile. Very rarely a Mosasaur reached a length of forty feet and even twenty-five feet is large, while the great Mugger, or Man-eating Crocodile, may attain a length of thirty feet, a fit match for most Mosasaurs.

The first of these sea-reptiles to be discovered now reposes in the Paris Musee d'Histoire Naturelle, after having changed hands several times. The original owner, M. Hoffman, presided for weeks over the arduous task of separating the remains from the surrounding rock. The extraordinary discovery excited so much interest that the canon of the nearby cathedral, as lord of the manor, laid claim to the fossil and succeeded, after a long and harassing lawsuit, in obtaining the precious relic. But during the French Revolution, the armies of the Republic, advised by a committee of savants, spared from bombardment that part of the city in which the fossil was known to be. Shrewdly suspecting the reason for the peculiar favor shown his residence, the canon concealed the specimen in a vault; but when the city was taken, he had to give up his ill-gotten prize which was then moved to its present museum location.

The seas that rolled over western Kansas were the headquarters of the Mosasaurs and thousands of specimens have been taken from the chalk bluffs of that region, some so well preserved that we are well acquainted with both internal structure and outward appearance. They were great, overgrown, swimming lizards adapted to a roving, predatory life by their powerful tails and paddle-shaped feet. Their cup-and-ball vertebrae gave great flexibility of body, their sharp teeth helped capture slippery prey and the structure of the lower jaw shows that they bolted their food in great chunks. In snakes, which also swallow their prey entire, the two halves of the lower jaw are loosely over the gape of the mouth. The pelican solves the same problem by the length of his mandibles which bow apart to form a nice, little landing net. In the Mosasaurs each half of the lower jaw was joined so as to bow outward when opened and to add greatly to the swallowing capacity. Extend your arms at full length, the palms touching, and then bend your elbows outward and you'll get an idea the action of a Mosasaur's jaw.

The western sea was a lively place in the day of the great Mosasaurs, for with them swam the king of turtles, Archelon, a dozen feet in length, its head a full yard long. In the shallows prowled great fishes with massive jaws and teeth like spikes and the great, toothed diving-bird Hesperornis. Over the waters flew pterodactyls, reptiles with a wing-spread of twenty feet, largest of all flying creatures and very probably

Tylosaurus; terror of the Kansas seas. — Am. Mus. Nat. Hist.

flesh-eaters too. When all these were seeking their dinners, there were troublous times for smaller fry in that old Kansan sea.

Then came a change. To the south, west and north the land was slowly but surely rising, only an inch or two in a century, but still rising. Its area contracted and ridges of the sea-bottom came to the surface as long, low bars that imprisoned the sea-life and subjected it to many risks. The stronger more readily captured the weaker and the fishes gradually died out through the constant freshening of the water. With the death of each considerable group, the balance of food supply was upset and many large species disappeared from the scene. The more omnivorous and enduring long resisted starvation, but finally yielded to inexorable fate—the last was caught in a shallow pool from which his exhausted energies could not extricate him.

Man Carries His Past With Him

By CLEVELAND SYLVESTER SIMKINS

ON a slab before me lies the partly dissected body of a man. Several things about this body immediately attract the attention of one accustomed to looking upon the human insides. The muscles on the belly and chest differ from the great run of men. The straight belly muscle instead of ending at the lower border of the breast bone runs to the root of the neck and blends with the muscle leading from collar bone to back of head. This condition occurs once or twice per hundred people. Very few physicians ever see it, since they usually dissect but one body in their entire career. So it is only the trained student in the structure of the human body that asks and tries to answer the question: How came such variation to be?

The easiest way to answer the question would be to call it a whim of providence. But the scientific student will look for possible cause. One is an injury. He finds no scars, no tough bundles of repair tissue; so he discards the injury suggestion. Another is faulty development. Can this be a reversion to an ancestral condition?

The muscles on the belly of the lizard run from the pelvis to the lower jaw in a continuous series, very much like the muscles of the body on the table before me, suggesting the possibility that this is a reversion.

If the straight belly muscle is examined in any normal man, closely and carefully as the dissector does over the dissecting table, four strips of gristle will be found running across it. These strips did not just happen to be there. There's a reason. It is found in the reptiles.

In reptiles the belly muscles are separated into a series of segments, with ribs separating the muscular bundles. Ribs on the belly? Exactly. And these ribs gradually disappear as the reptiles transform into mammals. But in their place is left a series of strips of gristle as representatives of these ancient ribs. Mankind, without exception, shows these marks of reptilian origin. Monkeys and apes also show that they too came from the same remote stock.

In the same body that showed such strange condition of the muscles the vermiform appendix was very long and coiled, and about as big around as a lead pencil. Usually in man it is but two or three inches long. In this case it was fully six, yet showed no evidence of any function whatever. Why is it sometimes absent in man, usually so small, and here so large? Why is it present at all? Merely to plague the life of man? By no means.

Its function must be looked for in the bowels of the lower animals. All animals that live upon grass, herbs and fruits have a well developed caecum, corresponding to the appendix. It aids them in the absorption and digestion of herbs and grasses. Animals that live upon flesh have a very simple digestive tract in comparison, with no vermiform appendix, or one much reduced. In the orang, a fruit eater, the appendix is long and coiled, as in the cadaver just dissected. In the gorilla, living upon herbs and fruits with a minimum of flesh, there is a long and spiral appendix. The chimpanzee, however, whose food more closely resembles that of man, has a relatively short appendix.

The function of the appendix seems to have been connected with the digestion of herbs and fruits. As the diet changes, so does structure and form of the appendix. Man, who eats everything, and most of that cooked, has very little need for the appendix, and nature is slowly getting rid of the useless structure. In some individuals she succeeds in eliminating it entirely, in others she only reduces it, while in still others with a strong tendency to revert to ancestral type the appendix is correspondingly large.

The human body contains over one hundred organs that show this tendency to revert to the type of man's ancient ancestors. To call attention to each one of them would require a good sized book. Every one of them illustrates the fact that man has slowly evolved from a very lowly ancestor.

THE GOLDEN LAW

By FRANK GOSLING

"All matter, mind and spirit, all is mothered out of strife,
The Iron Law of Struggle is the Supreme Law of Life"—
'Twas thus the poet ended. Yet, in stanzas five above,
He'd never mentioned altruism! *No, nor* Mother-love!

Now, half the truth won't satisfy the philosophic mind!
It surely doesn't follow that we can't *leave strife behind!*
"There never was nor will be from the strife of life surcease"
Is too dogmatic while 'The Riddle' plays the mystic Fleece.

"Time never was when it was not."—The poet, p'raps, was there?
If not, he ought to say 'I think': the open *mind won't dare*
To use a poet's license thus in writing of the days
When laws long-lasting may, *perchance, have 'worked' in other ways!*

An early sexless being might have said "there can't be Love,
I've made investigation, finding nought but Push and Shove!
'Time never was when such was not—*and,* therefore, *don't you see,*
This thing called Love can never, never, never, never be!"

And Sabretooth, though tasting love of mate and, p'raps of cubs,
Could hardly dream of other-*love!—And that's just where it rubs!—*

Of present, past and future, *with Einstein knocking round,*
We need to speak most cautiously,—*be careful of our ground!*

The pseudo-*scientific* mis*interpretation sad*
of Darwinism, leads to War! And fraticide seems mad!
Kind Darwin never, never preached that we *must ape the Ape;*
He surely guessed the other *way Humanity might shape.*

It seems to be a law of nature, nature shall be fought!
So why not turn our human minds to bring life's strife to nought?
And thus, in fighting nature, win some peace for Man at least
With yet, perhaps, a modicum for fish and bird and beast.

. . . . . .

A quibble? Maybe, Yes! It seems some struggle must remain,
We find it hard to think of Life without we think of Pain:
Yet talk *of 'strife',* unqualified, *allows the babe or fool*
To dwell upon the 'brute' and miss the Strife-won Golden Rule!

Perpetrated 1-12-28, by F. Gosling, of 23, Newick Road, Clapton, London, E. 5, as an attempt to counteract the effect of the beautiful poem of Covington Hall in 'Evolution' (Oct. 1928), upon those who have not gone quite so far in thought as he has. No offense whatever intended!

How Long Will the World Last?

By JOSEPH McCABE

SCIENTIFIC men have differed much in the last fifty years as to the past age and probable future of the earth. The mathematician was correct, but the physicist gave him the wrong material for his sum. How can he be sure that he now has the right material? He cannot be absolutely sure, but I will explain how little room for doubt there now is about the matter. There is a general agreement about the point, and the skepticism of people who know no more about the subject than they know about the arteries of a cod-fish, is as idle as the crackling of thorns under the pot.

Until twenty years ago we had three chief ways of determining the age of the earth which is closely connected with the question how long it will be fitted to sustain life. The water of the ocean was originally fresh, because its salts are being actually conveyed into it today by the rivers. The water itself notoriously evaporates, leaving the salt behind, and returns, with a fresh burden of salt, in the rivers. In other words, the proportion of salt in the ocean is steadily increasing, and by analysis of the water of many rivers we can ascertain, roundly, what quantity of salt is added to it yearly. Obviously, the further we go back in past time, the less salt there would be in the ocean, and it is a fairly simple mathematical sum to determine how far back we must go to find the waters of the earth free from salt. Somewhere about seventy million years, said the experts.

There was always a recognized weakness in this estimate. It supposes that through all geological time the rivers bore to the sea much the same proportion as they do today. The same weakness, one may say the same unjustifiable assumption, lay in the purely geological method of calculating the age of the earth. The rivers bear mud and sand and stones to the sea; where new strata are formed, and patient investigation can find what burden of sediment the great rivers transfer from the land to the ocean-bottom every year. American geologists have thus calculated how much of their precious land is deposited on the floor of the Atlantic and Pacific every year. When the majority of geologists working along this line reached a conclusion not very different—between fifty and a hundred million years for the formation of the stratified rocks of the earth, it seemed impressive.

The fallacy or weakness in both cases is to suppose that during all geological time the rivers bore, on the average, much the same load of sediment to the seas as they do today. It is a big assumption in the case of a globe which, as we now know, has had so many ups and downs in the course of its life.

Another mischief was that, on a third and quite independent line of reasoning, Lord Kelvin gave a figure for the age of the sun which seemed to harmonize with, and confirm the geological estimate. In those days men could see no substantial source of the heat of the sun and the stars except the compression of the matter composing the globes, and Kelvin started from this theory. We now know a source of heat which is enormously more effective and would sustain the temperature of the sun during a period of time twenty times as long as the longest period assigned by Kelvin.

This source is radio-active matter (uranium, thorium, etc.), the heat-producing quality of which we realize as an absolute fact in the laboratory. We have only to suppose that the interior of the stars is composed of masses of these heavy and unstable metals, and we have, since we know their weight, a source of heat which will last for billions of years.

It is always amusing to listen to the gentleman who prides himself on his common sense and asks us to be skeptical about these estimates and theories. Most of his own opinions about cosmogony are inferences drawn by imperfectly educated dervishes from bad translations of forged documents of an age of colossal ignorance; but his opinons are sacred enough to be protected by gunmen if necessary, while he can smile at an opinion laboriously reached by a thousand mathematicians of almost magical skill, profoundly critical judgment, and years of the most learned calculations. The mathematician asks the physical astronomer — though the two branches are really combined, since every astronomer is a good mathematician—what the probability is that vast stores of radio-active matter exist in the sun. We cannot prove it, as we can prove the existence in the sun of oxygen or iron, because our instruments analyze only the glowing surface of the sun. But it is an elementary truth of astronomy that the lighter elements remain at the surface of a globe and the heavier elements lie below—it is just as natural a process as when you see the stones brought down by a river remain in its bed while sand is taken out to the seashore and the fine mud borne far out to sea—and no one with any knowledge of these matters can have any doubt that there must be vast quantities of the heavy radio-active metals in the interior of the sun.

A few grains of uranium notoriously give off heat and other forms of energy, and one has at once a vague idea of the possibility if we suppose that billions of tons of this material exists in the sun. But we have another matter to take into account; the terrific pressure put upon the central matter of the sun and stars by the mass of the globe. As the total weight of the sun is well known, this pressure in the interior can be calculated, and the effect on the material can be gathered. The state of matter in the interior of the sun, or even of the earth, is beyond the power of our imagination, but the abstract formulae of the mathematician can penetrate to the very heart of it, and for those who are interested in these matters the modern analysis of the interior of stars is as impressive as it is fascinating.

The total energy poured out by the sun every minute or year is known. The amount of radio-active matter needed to give off that energy—astronomers now say to be converted into that energy—is known. The weight of the sun is known. Naturally one must not regard this conclusion as "mathematical" in the same sense as the addition of your bank-balance is. For most of us it is enough that the masters of this branch of science have, after ten or more years of critical and laborious estimates, agreed that the sun will probably continue to give light and heat enough to support life on this planet for a future period which is nearer two hundred million years than one hundred.

What matters to us is the value of this conclusion to our human outlook on life. We count our civilization as five or six thousand years old, and it is still so foul with injustices and stupidities that many wonder occasionally if the human endeavor is not futile: if history is not going to be always a series of advances and retrogressions into Dark Ages. On the other hand we have the thoughtless crowd and the imperfectly or wrongly educated people who seem incapable of visualizing any higher civilization than ours.

I am confident that much of this thoughtless attitude could be corrected if the school planted so deeply in the minds of pupils this new conception of the meaning of life that they could never wholly forget it. What are five thousand years in face of this stupendous future of the race? We learn a healthy contempt of our own institutions; and by a healthy contempt I mean the sure and steady realization that every institution or idea of which we may be proud today is child-like in comparison with the ideas and institutions of the future. We may be fully human, but we are the infants of civilization. It has hardly yet begun. Tens if not hundreds of millions of years of scientifically ordered life lie before us.

—U. B. U. Bulletin.

RUBE: What do you think about this here Evolution?

YOKEL: It's a good idea—but can they enforce it?

—American Boy Magazine.

EVOLUTION

A Journal of Nature

To combat bigotry and superstition and develop the open mind by popularizing natural science

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CONVENTION REPORTS

As this issue of EVOLUTION goes to press the world's greatest gathering of scientists is convening. Undoubtedly from their sessions will come forth many a message marking an advance in science, pushing farther out the frontiers of human knowledge, perhaps throwing a searchlight beam from our little island of light into the encompassing ocean of darkness. And they may give us an inkling of what the scientific method means, an appreciation of the thoroughness and infinite care that attend the announcements of scientists.

The next number of EVOLUTION will contain some informal reports of the Convention.

A RESOLUTION NEEDED

Surely it is not too much to hope that from the Convention there will issue a call to mobilize the friends of science for the pending struggle against organized religious bigotry. May it speak in unmistakeable terms to those who would turn back the hands on the clock of progress by passing laws against the teaching of evolution. Certainly the Advancement of Science demands a militant championship of the right of teachers to teach the truths of science. Anything less would be a denial of all sense of social responsibility.

ALMOST TWO TO ONE

The vote on the anti-evolution referendum in Arkansas is reported as: YES 108,991; NO 63,410. Majority 45,581. It is interesting to note that the heaviest vote AGAINST the proposed law was cast in some of the solidly fundamentalist rural districts. This is explicable only on the theory that these good people were confused by the awkward wording of the question and thought that by voting NO they were voting against the teaching of evolution. There's a real man's sized job ahead, friends, to educate the people.

IDEAS TO CLASH IN NEW YORK

A real clash of ideas will take place when Rev. W. B. Riley and Joseph McCabe meet in the great evolution debate, Thursday February 7th in Mecca Temple.

This will not be a mere war of words between elocutionists to entertain an audience. Each speaker is in deadly earnest. Each will do battle for his most profound convictions. Each, through a lifetime of activity on behalf of those convictions, has already achieved world-wide recognition as their champion.

Rev. W. B. Riley, President of the World's Christian Fundamentals Association, is prime mover and chief organizer of the anti-evolution campaign. He has participated in twenty debates on evolution, and according to the judgment of the audiences he defeated the evolutionist in all but one of them.

Prof. Joseph McCabe received his early training in the Catholic Church and was at one time in a monastery, but he now has back of him thirty years of fighting for freedom of teaching. He is known on three continents as the greatest popularizer of science. Wherever English is spoken live his students and disciples.

These two champions have met in the arena before. According to Rev. Riley, Prof. McCabe is the only man who ever won a decision over him in debate, and that before a rationalist audience in Chicago. At their most recent meeting in Toronto, Canada the audience voted three to one for Riley and against evolution. Of course it is only fair to state that there they were overwhelmingly fundamentalist.

So each speaker will be specially anxious to win the approval of the cosmopolitan audience that New York will furnish for this final and decisive debate.

In addition to the vote of the audience, it is planned to have a committee of thirty three judges.

EVOLUTION is naturally pleased at being instrumental in bringing two such outstanding personalities together in this city. We do not care very much who proves to be the better debater, nor how the audience and judges vote. Our purpose is to cultivate the Open Mind. We believe that the more both sides are heard, the more we shall win over the forces of fundamentalism. Rev. Riley has a similar faith in his plea. Hence the debate.

This promises to be such an intellectual treat as has never before been offered in this city. It is a tremendous undertaking for such a youthful journal as EVOLUTION, and the co-operation of every reader in the East is invited to make it both a moral and a financial success.

Start right now to organize a "line party" for this debate among your friends. Readers as far away as Boston and Baltimore are expected to get up groups to come to New York for this occasion. Teachers should plan to bring their students. All desiring blocks of seats should reserve them at once.

OF INTEREST TO SCIENTISTS

Most of the science articles appearing in EVOLUTION popularize matters with which every well informed scientist is already familiar. This is necessary to make the journal of value to laymen. But in every issue we expect to have at least one article carrying in somewhat abridged form the essential information contained in studies published in scientific journals, which because of their limited circulation are not yet generally known. For instance, the article by Dr. J. Leon Williams on "New Evidence of Man's Relationship to the Anthropoid Apes" in our last number, and the article by Prof. Wm. K. Gregory in this issue.

During the course of the year EVOLUTION will contain much material that is new even to the best informed men of science.

"THE FIGHT IS JUST BEGUN"

EVOLUTION has endeavored to impress upon its friends the fact that the anti-evolution agitation in Arkansas is not a mere local phenomenon growing out of the supposed backwardness of that State, but the beginning of a far-reaching campaign of fundamentalist fanatics to dominate the schools. Here's confirmation from the official organ of the American Anti-Evolution Association, the *Baptist and Commoner,* of November 21st, 1928:

> "The evolution fight has just started. Other states will be encouraged to make the fight since we have won in Arkansas. Some of the legislatures may pass the law and other States can initiate it as we did in Arkansas. Yes, we need money to push the work all over the land. It is like the prohibition fight. We went on with it for fifty years until we got national prohibition and now the work is to enforce the prohibition law. It will be the same way with evolution fight. THE FIGHT IS JUST BEGUN. We have won in Arkansas but there are forty-five other states where the fight must be made and then even after that we have the rest of the world. Let us get narrow provincialism out of us and have a world vision for all the work. There are many people who live outside of Arkansas and many who live even outside the United States. Let us make evolution illegal all over the world. Let us thank God and take courage."

This should help to disabuse those gentle, diplomatic friends who thought that by "keeping still" and "keeping out of Arkansas" they would "refrain from arousing prejudice" and thus fool and defeat the fundamentalists.

Only an agressive campaign of popular education can save the day for science. EVOLUTION will co-operate with every such endeavor.

The Text Book Hoax

An expose of the hypocrisy behind the publication of biology text books.

By BARROW LYONS

UP to the present, no serious attempt has been made in Arkansas to keep the dictionaries out of the schools, which make perfectly plain the basic idea of evolution. Yet the influence of the Fundamentalists has made itself felt quite enough. Even before the Scopes trial they had succeeded in impressing their blight upon the authors of biology text books through bringing pressure to bear upon the members of text book commissions.

Usually the gentlemen on these commissions, being good natured, accomodating and particularly anxious to keep out of unpleasant controversies involving religious prejudices make no very stirring effort in behalf of science. They take the easiest path and adopt texts certain not to get them into trouble with the arch trouble-makers.

An interesting example of modification in text book making is furnished in the volume entitled *Biology and Human Welfare* published by The Macmillan Company in 1914. The joint authors of this book were James Edward Peabody, head of the department of biology at Morris High School, New York City, and Arthur Ellsworth Hunt, head of the department of biology at Manual Training High School, Brooklyn. In their preface they say:

"The field of biology is so large and some of its problems are so difficult that a wise selection of topics must be made if a text is to attain its maximum usefulness. Consequently, some topics that are often found in secondary school texts, but are more suitable for discussion in advanced courses, have been omitted. Among these may be mentioned Mendel's laws, theories of evolution and mitosis."

There is a footnote to the word evolution, which reads:

"'The prominent evidences of relationship suggesting evolution, within such groups as the decapods, the insects and the vertebrates, should be demonstrated. A few facts indicating the struggle for existence, adaptation to environment, variations of individuals, and man's selective influence should be pointed out; but the factors of evolution and the discussion of its theories should not be attempted.'—Quoted from the syllabus in advanced zoology published by the College Entrance Examination Board and the New York State Department of Education (1921). This syllabus is based upon the report of a committee of the American Society of Zoologists, Eastern Branch."

Dr. Peabody has been criticized as giving the impression that the American Society of Zoologists, Eastern Branch, intended that the facts of evolution should be left out of elementary and secondary school texts, but the real intention of the zoologists was merely to suggest that a detailed discussion of evolution was somewhat beyond the grasp of most high school students.

Mr. Peabody's argument, moreover, seems somewhat lame when one compares the text of his earlier book, *Elementary Biology* written in collaboration with Mr. Hunt in 1912, in which the grounds upon which a belief in evolution is based is set forth very clearly. There seems to be nothing beyond the grasp of high school students in the following excerpt taken from page 114:

"We have seen in our study thus far (1) that no two individual plants even of the same kind are exactly alike, (2) that enormous numbers of seeds are produced by plants, and (3) that there is inevitable competition or struggle for existence. The question, then, that confronts us is this: Which of the many competitors will survive in the struggle, reach maturity, and finally reproduce themselves? Obviously those individual plants that vary from the rest in such a way that they can best adapt themselves to their surroundings."

Here is rank Darwinian heresy stricken from the pages of the later book. And this:

"Not only can man secure new varieties of plants by watching for favorable variations and perpetuating them from year to year, but he can actually be instrumental in producing new kinds of plants, the process is known as plant breeding."

The text book commission of Texas has gotten around the difficulty nicely by changing the word *evolution* to *development.* This is illustrated in the text book entitled *New Biology* published in 1924 by Allyn and Bacon, the authors of which were W. M. Smallwood, of Syracuse University; Ida L. Reveley, of Wells College, and Guy A. Bailey, of Geneseo State Normal School.

Apparently there were two editions in 1924. The text on page 156 is slightly different in each. In one text, under the caption *"Evolution,"* appears the following:

"The same study of the tadpole also illustrates how animals may gradually have come to live on land, and suggests a natural explanation for the origin of land vertebrates."

In the other text, under the caption *"Development,"* the book reads:

"This same study of the tadpole also illustrates how animals, which for a long time may have lived in the water, could gradually come to live on land."

It is a fine point, but it seems to have satisfied the Fundamentalists of Texas. The original edition, it is understood, is used for consumption by Northern school children, while the elimination of the word *evolution* made it fit for little Fundamentalists.

Commenting upon this situation a member of one of the larger text book publishing firms explained:

"A good many of the members of state text book commissions are not themselves anti-evolutionists, but they must listen to the Fundamentalist preachers, who although very much in the minority, control large slices of public opinion. The commissions in some states have found that by leaving out the word *evolution,* that most of the subject matter ordinarily taught under evolution can be left in the texts. Probably most of the Fundamentalists themselves are not very clear as to what evolution means. Pictures which illustrate the subject seem to irritate them more than the texts."

It is to the credit of Ginn and Company that it has republished in its 1928 edition of Dr. Benjamin C. Gruenberg's *Elementary Biology* the chapter on *Applications and Theories of Evolution,* which were originally published in the book; but the firm also insisted upon having a book by the same author in which the word evolution should be omitted, even if the facts be camouflaged under other names.

"I was asked to do the same thing Peabody and Hunt had done," Dr. Gruenberg told me. "It appeared to me at first a stultification to comply. A publisher has no right to impose on the author criteria from a specific point of view arbitrarily, even if it seems expedient. I went into the woods, to my study at Lake George, to think the matter over. I decided to put the question of using the word evolution in the background and write a book, reconsidering my problem as I came up against it in the book. The final outcome was that I finished the book and hadn't mentioned evolution anywhere. I went over the work carefully. Outside of explicit mention of evolution and a discussion of the various theories, it was the same biology as I taught and had written.

"There are to be found in the Southern states and certain parts of the Middle West, whole populations a generation behind those one finds in our large cities and in Europe. Is it better that the children in the backwoods have no book at all? To me it was a problem of taking the world as one finds it, which most of us must do if we want to play with it at all."

A similar thought was expressed by a publisher, who like the others quoted, insisted that his words remain anonymous.

"Every farmer in the United States believes in evolution," he declared. "Talk with him for fifteen minutes and you can convince him that the improvement of live stock and plants is based entirely upon its laws.

"I think it exceedingly important that the social significance of evolutionary principles be thoroughly understood, yet I cannot print text books that mention or discuss evolutionary principles. It isn't because I haven't the nerve, but because I have creditors. To them a fearless stand for the truth would simply mean courting the possibility of losing business, and my

The Verdict of Science

The men of science in the United States are practically unanimous in their opposition to the fundamentalists and their anti-evolution laws. This conclusion is based on a referendum conducted by EVOLUTION among the members of the American Association for the Advancement of Science. In answer to the question: "Should teaching that Man is ascended or descended from a lower order of animals be prohibited by law?" 1078 of the 1098 ballots already received were marked NO, while only 20 voted YES.

There was a greater diversity of opinion on the second question submitted: "Should the American Association for the Advancement of Science take a militant attitude against fundamentalist anti-evolution laws?" 764 voted YES, 277 voted NO. Quite a number did not vote because of doubt as to the meaning of *militant*. The majority of three to one in favor of the Association taking a militant stand seems very impressive.

The third proposition met with even greater favor. "Should the American Association for the Advancement of Science express itself against the elimination of evolution from biology school texts by publishers in fear of fundamentalist influence?" was answered in the affirmative by 958, while only 123 voted in the negative. This shows emphatic opinion on this subjct on the part of the scientific world. If this finds expression it will undoubtedly encourage the publishers of unadulterated texts on biology. In this connection the article by Barrow Lyons "The Text Book Hoax", on aanother page of this issue is particularly enlightening.

The fact that there actually exist some members of this most august body of science who think that the teaching of evolution should be prohibited by law is of course most remarkable. The twenty are distributed as follows: District of Columbia, 1; Illinois 4; Kansas 1; Massachusetts 3; Minnesota 2; New Jersey 2; Ohio 1; Pennsylvania 3; Washington 1; Wyoming1. It will be noted that not a single one of these hails from Arkansas, Tennessee, or the much maligned South.

The response to these THREE QUESTIONS submitted by EVOLUTION is very encouraging. It shows that among scientists generally there is a splendid sense of responsibility toward the public. Undoubtedly, as the fundamentalists push their campaign to control education, the scientific world will become more and more active, until even those that now take the position "the less said, the better" will realize the necessity of positive effort at popular education in natural science.

Here is the vote detailed by States:

	No. 1		No. 2		No. 3	
	Yes	*No*	*Yes*	*No*	*Yes*	*No*
Alabama	—	9	6	2	6	3
Arizona	—	7	7	—	6	1
Arkansas	—	6	4	2	6	—
California	1	87	61	22	74	14
Canada	—	5	4	1	4	1
Colorado	—	19	16	3	15	4
Connecticut	—	31	20	8	28	3
Delaware	—	9	7	2	9	—
Dist. Columbia	1	59	44	13	55	5
Florida	—	6	6	—	6	—
Georgia	—	6	4	2	6	—
Idaho	—	1	—	1	—	—
Illinois	4	88	68	20	82	10
Indiana	—	9	7	2	7	2
Iowa	—	22	11	10	18	3
Kansas	1	22	15	9	20	4
Kentucky	—	11	7	3	11	—
Louisiana	—	4	4	—	4	—
Maine	—	7	7	—	6	1
Maryland	—	31	21	9	27	3
Massachussetts	3	83	64	14	77	7
Michigan	—	32	21	8	29	3
Minnesota	2	33	26	8	32	3
Mississippi	—	5	3	2	4	1
Missouri	—	34	23	9	28	6
Montana	—	7	6	1	7	—
Nebraska	—	18	11	7	14	4
Nevada	—	1	1	—	1	—
New Hampshire	—	7	7	—	7	—
New Jersey	2	6	5	2	7	—
New Mexico	—	2	2	—	2	—
New York	—	49	34	13	40	—
North Carolina	—	9	6	2	8	1
North Dakota	—	5	5	—	5	—
Ohio	1	66	41	21	56	7
Oklahoma	—	21	14	5	17	4
Oregon	—	8	7	1	8	—
Pennsylvania	3	87	58	30	79	19
Porto Rico	—	1	1	—	1	—
Rhode Island	—	9	8	—	8	—
South Carolina	—	12	3	7	8	3
South Dakota	—	4	—	3	4	—
Tennessee	—	16	8	8	15	1
Texas	—	28	20	8	25	2
Utah	—	6	4	1	6	—
Vermont	—	9	6	4	10	—
Virginia	—	27	22	4	24	—
Washington	1	15	11	3	13	3
West Virginia	—	13	8	2	10	2
Wisconsin	—	23	16	7	20	2
Wyoming	1	3	3	—	3	1
Totals	20	1078	764	277	958	123

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creditors would not have much confidence in me if they thought I were throwing business away.

"Under the laws of evolution only those will survive in the struggle for existence among text book publishers, who adapt themselves best to their environment, and their environment at present is one in which the Fundamentalists largely control the situation, at least in the elementary and high schools. If teachers who are not controlled by the Fundamentalists were to take an organized stand in the matter, perhaps the environment of text book publishers would be changed."

That is the situation. The problem of meeting it is chiefly that of the teacher—the one person most interested in the promotion of sceintific information.

$5,000 PROMOTION FUND

Dr. Martin Dewey, who has already been very generous in his support of EVOLUTION, has pledged himself to contribute $1,000 to the $5,000 Promotion Fund in monthly payments of $100 during 1929. This brings the pledges up to $2,000.

The amounts paid since last report are: Albert C. Dieffenbach $10.00; Fritz Gannon $1.00; W. R. West $1.00; Martin Dewey $100.00; Mrs. T. M. Nagle $10.00; Wm. K. Gregory $200.00; Frederick Tilney $200.00; Morris Weinberg $200.00; Chas. Fuchs $5.00; Wm. M. Brown $25.00; M. Mark $50.00; Howard Lilienthal $5.00; Meyer Friedman $1.00; A. B. Cohen $10.; E. R. A. Seligman $10.00; L. T. B. Light $100.00; A. Friend $25.00; B. A. Dyer $1.00; F. R. Wulsin $4.00; W. H. Waigbt $4.00; R. D. Spencer $1.00; David N. Schaffer $2.00; Albert Bohm $5.00; Hugh Miller $1.00; E. C. Boxell $4.00; Geo. G. Leidhecker $1.50; J. S. Horsley $5.00; Arthur Garfield Hays $10.00; Geo. Welby Van Pelt $5.00; S. E. Telleson $1.00; Carl Keller $1.50; A Friend $10.00; E. L. Fantus $10.00; Margaret Crowder $1.00; I. M. Miller $10.00; F. K. McFarlan $5.00; Total $1,035.00.

Previously reported paid, $1,175.00; Pledges $2,000.00; Grand Total $4,210.00.

This leaves less than $1,000.00 to be raised to complete the $5,000 fund for Evolution Promotion Campaign. Surely enough other friends of EVOLUTION will now step forward to push this Fund over the line with a rush.

As previously announced, a share in the Publishing Corporation is given for every $10 paid in, and an extra voting share with every $50.00.

HONOR ROLL

EVOLUTION measures its success by the number of readers who qualify for the Honor Roll. If the journal does not move its readers to ask others to read it has failed in its purpose. Although, of course, we hope to please the evolutionists it is not published primarily for their own edification, but as an instrument with which they may enlighten their neighbors. These friends therefore have our greatest appreciation. May we count YOU among them next time?

32 Ella A. Holmes	5 A. Bogard
17 Lida C. Brannon	5 S. Ratner
9 Frank Masek	5 A. L. Davis
6 Gustav Weiss	6 Chas. F. Clagg
6 Sam Katz	5 I. M. Miller
6 E. W. Thomas	5 E. G. Clemmer
6 G. E. Marsh	5 F. K. McFarlan
5 Chas. Kiehn	

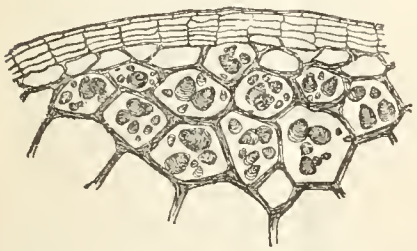
and three each from S. S. Ruck, C.H. Low, F. A. Varrelman, Emerson Miller, F. K. Fassett, Mm. McIntyre, C. M. Schoch, M. S. Deland, S. F. Brooks, F. S. Darling, W. L. Abbott, F. J. Trompour, Geo. F. Knowlton, H. D. Oppenheimer, Chas. S. Grause, Geo. A. Coleman, L. C. Daudant.

THE AMATEUR SCIENTIST

A MONTHLY FEATURE *conducted by* ALLAN STRONG BROMS

LIFE IN COLD STORAGE

One onion, one potato, one bean, one egg, some water and heat—sounds like a recipe, but it's just a way to take four forms of life out of cold storage. For plants and animals die or at least sleep off each winter, and must have ways of storing their lives for the next season or generation. Bulb and tuber and seed and egg are just different ways of keeping life in storage until conditions favor its active renewal and growth. All are food stores plus the spark of life, the onion a shortened stem of fattened leaves cuddled up close for warmth, the potato a thickened root.



Slice of Potato, with starch-containing cells

Look at a slice of potato, thin enough to be transparent, through a low power microscope and you will see the cells of which it is composed. The tough surface layer of flattened cells constitutes the protective skin, while the rounder, interior cells serve for storage bins. They are full of starch grains which you can see better by staining them with iodine, which always turns starch purple.

If you doubt the spark of life, give these plants a chance, some soil and moisture and warmth and watch them send out shoots ready to climb into the air and light. So with the bean, composed of a couple of leaves swollen with starch food and between them a miniature plant all set to grow when conditions are right. Put some soil in a tumbler and plant the bean at one side right next to the glass, keep it watered and warm and see it sprout, a root directed downward for moisture and anchorage, a leaf stem reaching upward for light and air. Meanwhile the old bean shrivels, drained of the food supply that gave the renewed life its quick start.

So too, the egg-stuff is food-stuff(how well we know it) encased in a protective shell and with a spark of embryonic life. Three weeks of steady warmth and your chick has its start in life, ready to peck its fat-fed self out of the emptied shell and into the busy world.

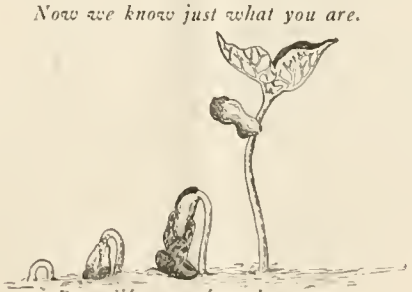
TWINKLING STARS

Winter nights are fine for observing the stars for they are longer and usually clearer, so the stars stand out brighter than ever. But summer or winter, an important difference can be noted between some of the brighter stars. Some twinkle; a few do not. Those that twinkle are true stars, great suns so many millions of millions of miles away that they are reduced to mere brilliant points of light which our strongest telescopes cannot magnify into anything but points. Those that do not twinkle are planets, worlds like our own that revolve around our sun and wander among the true stars. There are only five ever visible to the naked eye, Jupiter and Saturn, the giant worlds, Mars, the red world, Venus, the morning and evening star, and Mercury very close to the Sun and rarely seen, the baby of the system. All the planets are within some tens or hundreds of millions of miles, close enough for even small telescopes to show their round disks illuminated by the sunlight.

Why do true stars twinkle and planets not? We will find the reason in our own eyes. The retina of the eye, that inner, sensitive surface on which the light falls, consists of minute columnar cells packed close together with their small ends facing the light. The image of a planet's disk, focused as on a ground-glass by the camera-lens of the eye, is large enough, even though the naked eye cannot see it as a disk, to overlap several of the cell-ends so that some of them are constantly lit up and the light appears continuous. The disked planet therefore does not twinkle.

The light image from a true star, however, is a sharp point, so small that it does not overlap from one sight-cell to another. As it shifts from one cell-end to the next, it leaves the sensitive cell center and passes over the blind edge before reaching the center of the next. The light sensation is interrupted and the star appears to twinkle. If the image could be held steady on a single cell-center, it would not twinkle, but the eye itself is never steady enough and even if it were, the moving currents of miles-thick air between us and the star refract its light beam most unsteadily, so that the star seems to be jumping around slightly. The old verse now reads

Twinkle, twinkle, little star,
Now we know just what you are.



Bean-life out of seed-storage.

WINTER COATS

With the coming of winter snows, several northern animals would find themselves conspicuous in dark coats of fur or feathers against the whitened ground were it not that nature had evolved a seasonal change of color for their protection. The Arctic Fox, for instance, changes its coat with the seasons, having a dark one to fit with the darker ground of summer and a white one to go with the winter's snows. As the fox hunts by stealth, the advantage of seasonal coloration is obvious. The stoat lives and changes color the same way.

Similarly, hunted animals such as the grouse, ptarmigan and mountain hare change color seasonally to help hide them from predacious enemies. The ptarmigan has even a third coat for autumn, with patches that break up its bird shape into shapeless blotches when viewed against any solid-colored background, dark or light.

Such an animal as the polar bear, living always among arctic snows and ice fields, keeps its white coat throughout the year and of course the animals of temperate zones have coats blending with the ordinary darker backgrounds. In any case, the coat habit acquired through evolution is that which gives advantage in the struggle for existence. Hunter and hunted alike gain by being inconspicuous. Natural selection does the rest.

CELEBRATE DARWIN ANNIVERSARY

"On the 12th of February 1809 two babes were born whose names are known to every school boy and girl in the land, Abraham Lincoln and Charles Darwin. The Colorado Rationalist Association will celebrate the 120th anniversary of this event the evening of February 12th, 1929.

Through the columns of your paper will you please urge other societies to do likewise. One of these men emancipated four million human beings from the chains of slavery, the other has emancipated millions of human minds from the ignorance and bigotry of the middle ages. Is it not fitting that they should be remembered by the present age?"

O. O. Whitenack, Secy.

SHALL WE PUBLISH "THE PROOFS OF EVOLUTION" AS A PAMPHLET?

Dr. G. L. Howe, of Rochester, writes:

"Are you planning to publish in pamphlet form, "Proofs of Evolution", concluded by Henshaw Ward in the November issue of EVOLUTION?

"This is by far the most clearly put and most conclusive thing along this line that I have yet seen, and I myself should like to have several copies in pamphlet form."

We agree with Dr. Howe that Henshaw Ward's "The Proof of Evolution" fills the bill for a pocket sized pamphlet, and shall publish it if there is sufficient demand. It would retail at 10c a copy, and come in hundred lots at not more than 5c. Advise us right away how many you'd take.

Twigs from the Family Tree

By N. K. MCKECHNIE

Millions of years ago a forest fire drove a family of our tree-dwelling ancestors apart. Most of them escaped over a mountain pass into a warm and hospitable forest land, where through the slow milleniums no need arose for them to modify the ways of living of their fathers. But two youngsters, who had become separated from the others, remained, and their progeny was modified by changing environment and climate. We are their final descendants.

A few months ago on an almost inaccessible mountain in the heart of Africa an old male gorilla roused himself from the bed on which he had enjoyed his afternoon siesta and looked about him.

He was an awe-inspiring figure, the very embodiment of brute strength. Four hundred pounds in weight, seven feet in height when standing upright, the heavy body hung with enormous arms dwarfed the bent mis-shapen legs beneath. It was the arms in fact that forced themselves most upon an observer's attention. These mighty limbs reached to below his knees and were muscled like a man's thigh. They could tear the body of a heavy-weight prize-fighter in two. Nay, were their owner muzzled so that he could not use his powerful jaws and put in a closed room with the twelve leading champions of the ring, not one of those twelve would leave the room alive. These arms of his like the rest of his body were clothed with long hair, black except on his back and chest, which presented a grizzled, almost silvery, appearance. His dark face was almost bare of hair, but from the top of his small head rose a stiff bush of black bristles that added to his apparent size. His eye-sockets were deep caves, his nostrils gaped flat and wide, and beneath them jutted his formidable jaws.

On rising from his couch of twigs and grass he had at first half squatted with bent knees, the knuckles of his hands to the ground, but now he raised himself to his full stature and with head thrown back sniffed the heated air.

Yes it was there again,—the man-scent! For two days now it had followed them, arousing always a vague uneasiness in his breast.

They must move again.

He gave a chuckling kind of call and immediately the rest of the band began to rouse from their lairs and assemble round him. Gravely he waited until all were present and then gave the word to proceed. The oldest female led the way, the others bearing their babies came next, then the adolescent young, and finally when all had disappeared in the dark tunnel of undergrowth, the old man himself followed.

For two or three hours the march proceeded, the females stopping occasionally on reaching an inviting open space, but always continuing at the word of their lord, until finally the sun had sunk low and he approved of a halt in a small clearing where numerous eight foot high clumps of wild celery promised abundance of food.

Then commenced the going-to-bed preparations. The younger members of the party were tired and peevish, and disinclined to subject themselves to the customary maternal ministrations. But their objections were speedily quelled by a few sound slaps and shakings quite after the fashion of a human mother and each youngster was gone over by the painstaking parental fingers, ears, eyes and nostrils carefully inspected and cleaned, and all burrs and thorns picked from their fur before they were allowed to ascend the tree that the old male had selected for their bed-room that night. It stood apart from others, so that no leopard or other tree-climbing enemy could reach the sleeping-quarters except by way of the main stem, and there at the foot the old man prepared his own bed. Autocrat he might be but he would give his life ere one of his flock should be harmed.

It was still light when the family were all established in their aerial beds and there was a considerable amount of unseemly noise among its younger members in spite of the efforts of the mothers to quiet it; but the old man at the foot of the tree gave an admonitory roar and smote on the trunk with his hand and the chatter ceased as though by magic.

Then the sun set and as suddenly fell the tropic night. The gorilla family slept, and if the slumber of the old male was continually broken (for he always awoke at the slightest sound) it was no remembrance of the ill-boding man-scent that disturbed his rest. Out of scent,—out of mind.

But down the backward trail in one of the clearings through which the gorillas had passed, a white man and his black boys had made their camp, and their watch-fire glowed dully on the encircling trees.

The next day having fed well on the luscious celery the old man gorilla was making up arrears of sleep while his family amused themselves at large in the bush that surrounded the clearing, when a sudden uproar brought him leaping to his feet. The white hunter and his party had stolen upon him up-wind, had pounced upon an eighteen-month infant wandering from his mother, and while three stalwart blacks by their united efforts were forcing the struggling, fighting, soft-furred creature into a capacious sack, the white man with a moving-picture camera concealed in a bush was eagerly reeling off foot after foot of film destined to afford a few minutes entertainment to the sated inhabitants of the great man-cities from which he had come.

The old male glared around him. The wind, as we have said, was blowing from him to the men-folk and he did not sense their presence. But he saw the excitement of his wives and progeny, heard their danger signals and hastened towards what seemed to be the center of the disturbance. There some of the mothers were searching frenziedly for their infants, but others and a number of the older-youngsters were dodging about among the bushes peering over and through the foliage at a most unusual object visible at the margin of the clearing,—a white man who was waving his helmet to hold their interest while his black assistant hidden in the bushes cranked the movie-camera industriously.

The old male stopped astonished. Never had he seen anything resembling this. What was it? What did it mean? He, too, crouch behind a bush and stared at the mysterious apparition, his face wrinkling and twitching with curiosity.

But one of the females on the outskirts was more than excited; she was angry and in distress; she was clattering her teeth by rapid revolving motions of her hands beneath her chin. And a young male near her was endeavoring to alarm the intruders by sounding the war-drum, beating with his fists upon his immature chest.

The old man gorilla perceived them, moved in their direction, and as he went a strong whiff of the man-smell assailed his nostrils. Again the strange disquiet seized him, and with it anger at the persistence with which he had been pursued. He would drive them away. And raising to his full height he began to force his way towards the white man through the entangled bush, roaring like a lion, teeth-a-gleam, great fists causing his chest to reverberate like a drum.

Never before had such a spectacular advance failed of its purpose, but in this instance the enemy against whom it was directed did not quail. The white man stood his ground, and as the gorilla met his eyes a strange psychic force smote him, and for the first time in his life he feared. In futile vent for his emotions he seized a sapling, shook it passionately and with a single wrench tore it, roots and all, from the earth. Still the white man did not move. Still the mysterious emanations of human will impinged upon the gorilla's consciousness, benumbing his spirit, turning his heart to water. His universe was crumbling; in another minute he would have backed away, to have lived for ever after the slave of Fear.

And then suddenly among the trees he saw the dark forms of the negroes lugging the sack in which was the captured baby; he caught its scent; he heard its muffled cries;—and he came to himself again. All his,—shall we say "manhood"—surely that is not too high a term?—came back to him like a flood. Stronger than his fear of

Funnymentals

BER 19, 1928 No. 36

THE TERRIBLE CONSEQUENCES OF THE DOCTRINE OF EVOLUTION

Over and over again we hear the silly twaddle that it does not matter how we got here, whether by evolution or by direct creative act, but the important question is where are we going, what of the future? That sounds very well if it were not for the fact the Bible teaches that men FELL from a high and holy state or condition into sin and degregation. If evolution be true, if indeed man evolved, developed from a lower order to what he now is and is still evolving, it follows that he did NOT FALL and not only is the Bible contradictory concerning the account of creation but it is contradicted when it says man FELL. DID HE FALL UP HILL? Was his fall an improvement? Bound to be if evolution is true. But hold. If man did not fall then he needs no Savior. If he needs no Savior then Christ died in vain and if Christ died in vain then all we have been saying about redemption and salvation goes for nought. All we have been saying about the new birth is foulishness. The blood of Jesus Christ is of no value. And that is not all. If evolution be true there is no such thing as a miracle and none of the so-called miracles by Jesus were real. He was just a mysterious performer, a juggler, and sleight of hand performer. And that is still not all. He was the real son of Joseph—God was not his father. Then it follows that Mary was an adulteress, a liar, and a deceiver for she committed adultery and when she got caught she lied to Joseph, her espoused husband, and said that God was the father of her child and silly old Joseph believed her lie and continued in that deception not knowing that Jesus was a BASTARD AND HIS MOTHER A BAWD! Evolution means all that. Shall such a devilish doctrine be taught in our tax-supported schools? Shall religious people be taxed to pay teachers to tell our children that JESUS CHRIST IS A BASTARD? If that is not an outrage what could be? If infidels and atheists want to teach such stuff as that let them do it at their own expense. We should enforce our evolution law to the letter. Everybody get busy.

NO PAPER CHRISTMAS WEEK

It is our custom to not publish a paper

death or of this spiritual force more fearful than death was his instinct for protection of those he led. With a mighty roar he hurled himself towards the ravisher of his family.

What was this deafening blinding explosion that smote him as he leapt? What was this sickening shocking blow that struck him in his very heart,—paralyzing his muscles,—loosening his knees,—bringing him crashing to the ground?

Before his wide-stretched eyes the sunlight turns to darkness, and wondering, still wondering, at the Mighty Power which has laid him low, his undisgraced spirit passes from fleshly ken.

. . . . . .

The twins had met.

EVIDENCE OF DEGENERACY

In publishing under Funnymentals a photograph of a column from the front page of the Christmas number of the Baptist and Commoner, the paper that fathered the anti-evolution law in Arkansas, we do not mean to imply that all fundamentalists are of the degenerate type of mind of which that article is evidence. Many of them are noble and well meaning people, who simply don't know any better. But the hand that wrote that article is one of the controlling influences in the education of the children of Arkansas, and is now reaching out to dominate the teaching of science everywhere. Would you want that hand, and the type of mind that it reveals, to control the teaching of YOUR child? What are you doing to prevent it?

"THE MENACE OF DARWINISM"—

By WILLIAM JENNINGS BRYAN

64 pp., 12mo. Fleming H. Revell Co. 1922.

The cream of the late Mr. Bryan's pronouncements in reference to organic evolution can be found in this little pamphlet—"It is better to trust in the Rock of Ages than to know the Age of Rocks." Bryan occupies a position which is logically sounder than that of Price or O'Toole—he does not make any serious attempt to discuss the validity of the facts supporting the law of evolution, nor to assail any link in the chain of reasoning based on these facts, but regards an appeal to religious emotionalism as an adequate answer. "Having given Darwin's conclusions as to man's ancestry, I shall quote him to prove that his hypothesis is not only groundless, but absurd and harmful to society... He advances an hypothesis which, if true, would find support on every foot of the earth's surface, but which, as a matter of fact, finds support nowhere. There are myriads of living creatures about us, from insects too small to be seen with the naked eye to the largest mammals, and, yet, not one is in transition from one species to another; every one is perfect. It is strange that slight similarities should make him ignore gigantic differences. The remains of nearly one hundred species [sic] of vertebrate life have been found in the rocks, of which more than one-half are found living to-day, and none of the survivors show material change". Practically every statement in this quotation, explicit or implied, is untrue, as the author could have discovered by consulting standard works. "Is it not more rational to believe in *God* and explain the varieties of life in terms of divine power than to waste our lives in ridiculous attempts to explain the unexplainable." "Looking heavenward man can find inspiration in his lineage; looking about him he is impelled to kindness by a sense of kinship which binds him to his brothers. Mighty problems demand his attention; a world's destiny is to be determined by him. What time has he to waste in hunting for "Missing Links' or in searching for resemblances between his forefathers and the ape?"

Mr. Bryan, then, is personally uninterested in science nor does he accept the validity of the scientific method. That is, he regards conclusions reached emotionally as inherently superior to those reached by dispassionate and painstaking thought. When he ventures into a discussion of facts, he is unable to be accurate. Mr. Bryan's position is probably not seriously inconsistent with itself, but between such a point of view and that of a real scientist, there is no point of contact.

HORACE ELMER-WOOD II.

AGAIN WE SAY: *BOOKS*

One of the principal reasons for publishing a journal like EVOLUTION is to interest people in the reading of good books. We invite every reader to make himself an instrument for the circulation of such books among friends. For this there is no "off season". It is always timely, always in order.

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FROM OUR READERS

"Your stuff may work with some men. But I am not one of that bunch. So keep your damnable stuff. We don't need it here in Okla."—*G. W. Harris,* Luther, Okla.

"My opinion about the farce in Tennessee and Arkansas is that it will only stimulate the study of Evolution. All the ambitious youths and students will now dive into it and the actions of the fools in the different states will have one thing to their credit.

Gideon Penrod Marner, M.D., Kansas.

"We have had many fine reports in class by students getting their material from EVOLUTION.

I am teaching in a Methodist Denominational School in a Fundamentalist community and have poured evolution into the students as fast as I could feed it to them for four years and three summers. We had a modernist president but lately a change was made and a fundamentalist was appointed. Of course you know what happened without my telling you. Almost half of the instructors will not be hired for next year and I am looking for another position. The excuse for letting so many of us go was that the new president was going to economize by cutting out small classes but I notice that the liberals, materialists, and evolutionists are the ones to go." Kansas.

(For obvious reasons we have omitted the name).

"The age-old quarrel between religion and science gets right down to brass tacks in Mount Vernon Washington, where a farmer is haled into court for refusing to allow the state to test his cows for tuberculosis. Such a test, the farmer asserted, was contrary to his religion."

Portland News, (Oreg.) Dec. 17, 1928

PITY THE HEATHEN

If EVOLUTION reaches only convinced evolutionists it isn't worth printing. Our real task is to carry the facts about evolution to those who do not understand what it is all about, so they can no longer be stampeded by fundamentalists. This we can do only with your help. Order a few extra copies to give friends and neighbors. We'll send you five copies each month for a whole year for only $2.50.

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Dr. Abraham Myerson
Charles G. Norris
Arthur Schnitzler
George Bernard Shaw
Laurence Stallings
Hendrik Willem Van Loon

In the March Issue

HOW BRITISH GUILE SCUTTLED THE AMERICAN NAVY—By Rear Admiral Bradley A. Fiske, U. S. N. Materialist!—Anti-Christian!—Jingoist!—shouts the mob as Admiral Fiske tells what he knows about disarmament. And he knows **plenty**—whether you agree with him or not! A sizzing article, this, that will start 'em talking—loud and long!

THE DISAPPEARANCE OF THE HOME—by Louis Bromfield Mr. Bromfield—who writes **good** books, even if they **are** "best sellers"!!—gives us two startling pictures of what is humorously called the "home"—old and new. Prohibition, says he, did, of course, pull father away from the corner saloon—but it also sent the children to **gin** parties! And—**now** where are we?

THOMAS, SON OF GOD—By Carl Von Hoffman. An explorer and lecturer brings us, from darkest Africa, this fantastic, but true, story of a white man's religion, a native black man's mind, epilepsy and a desire for glory. Thomas, Son of God, follows a strange and bloody trail of evangelism.

WHO LAUGHS AT THE INSANE?—by John E. Lind, M. D. For 10 years in charge of the department for the criminal insane in a Washington hospital, Dr. Lind sees a gigantic and well-merited inferiority complex in those who laugh at the insane. Perhaps, we wonder, it's just as well to be half-witted as it is to be stupid.

Also these Provocative Articles

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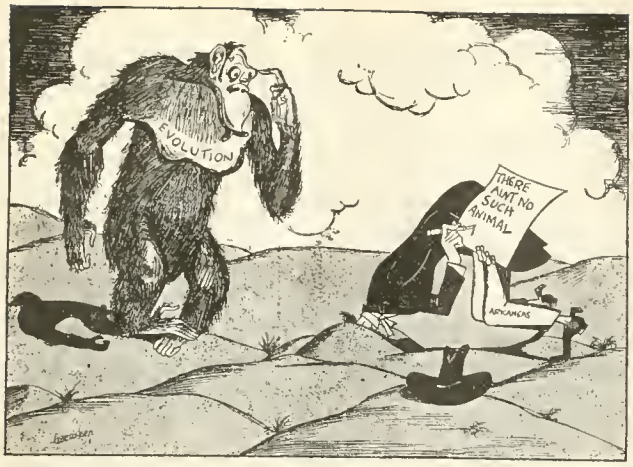

"The voice of the people is not always godlike. On the contrary, a majority vote is often foolish. Look at the absurdity of the anti-evolution law recently passed by a thumping majority of the voters of Arkansas . . .

"We have been deceiving ourselves a long time in talking about the sacredness of majority rule. There is nothing necessarily divine or even intelligent about the opinion registered by 51 per cent or even more of those voting on a particular measure . . .

"No man outside of Bedlam would think of inviting a town meeting to vote on the question of taking out somebody's appendix or of prescribing the strength of materials to be used in a bridge. Yet evolution is far more complicated than surgery or bridge building . . ."

—*From editorial in Collier's for Dec. 22, 1928.*

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